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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/688,817	10/17/2000	Ende Shan	196273US-0 CONT	2184

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EXAMINER
TOLEDO, FERNANDO L

ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 11/01/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/688,817	SHAN, ET AL.	
	Examiner	Art Unit	
	Fernando Toledo	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on *14 August 2002* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *17 October 2000* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received. .

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Specification

1. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Double Patenting

2. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

3. Claims 1 – 21 and 24 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 – 24 of U.S. Patent No. 6,140,228. Although the conflicting claims are not identical, they are not patentably distinct from each other because the U. S. patent 6,140,228 claims a specific range of temperature and power while the present application claims "that the deposition of a second amount of metal on the seed layer at a substrate temperature and power" with no specific temperature or power.

However, the temperature and power claimed in U. S. patent 6,140,228 encompass the claimed temperature and power of the present application.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to deposit a second amount of metal on the seed layer at a substrate temperature and power, since the U. S. patent 6,140,228 deposits the same second amount of metal at a defined temperature and defined power.

4. Claims 22 and 23 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 – 24 of U.S. Patent No. 6,140,228 in view of Xu et al. U. S. patent 6,217,721 B1. The U. S. patent 6,140,228 does not claim the formation of $TiAl_3$.

However, Xu et al. in the U. S. patent 6,217,721 B1 discloses forming a plug in a high aspect ratio hole with aluminum and a Ti or Ti compound as a wetting or barrier layer and that the combination of Al with Ti will form $TiAl_3$ if proper steps are not taken. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form $TiAl_3$ in the U. S. patent 6,140,228; because as taught by Xu, $TiAl_3$ can be readily formed with Al and Ti if proper steps are not taken.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 discloses the following limitation: "said seed layer being sufficient to cover said first substrate surface which is Ti at a substrate temperature of from 220 to 300°C".

It is not clear what is made of Ti. Is it a Ti substrate? Is the surface of the substrate composed of Ti? Or is it the seed layer that is made of Ti?

Examiner believes that what is made of Ti is the seed layer.

If Applicant wishes to traverse such assumption, the traversal should be made in the next response.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

6. Claim 21 is rejected under 35 U.S.C. 102(e) as being anticipated by Xu et al. (U. S. patent 6,217,721 B1).

Xu in the U. S. patent 6,217,721 B1; figures 1 – 22 and related text discloses i) depositing a seed layer of the metal on a first substrate surface, the seed layer being sufficient to cover the first substrate surface (column 20); ii) depositing a second amount of metal on the seed layer at a substrate temperature and power that are sufficient to (i) inhibit formation of filamentous metal phases (i.e. $TiAl_3$) having a resistivity greater than that of the metal and (ii) provide a metal diffusion rate and a metal deposition rate sufficient to inhibit void formation in an opening having an aspect ratio of at least 2.0 (columns 3, 23 and 24); iii) depositing a third amount of metal on the second amount of metal (figures 16 and 17).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1 – 20 and 22 – 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu.

In re claims 1, 22 – 24 Xu in the U. S. patent 6,217,721 B1; figures 1 – 22 and related text discloses i) depositing a seed layer of the metal on a first substrate surface, the seed layer being sufficient to cover the first substrate surface (column 20); ii) depositing a second amount of metal on the seed layer at a substrate temperature and power that are sufficient to (i) inhibit formation of filamentous metal phases (i.e. $TiAl_3$) having a resistivity greater than that of the metal and (ii) provide a metal diffusion rate

and a metal deposition rate sufficient to inhibit void formation in an opening having an aspect ratio of at least 2.0 (columns 3, 23 and 24); iii) depositing a third amount of metal on the second amount of metal (figures 16 and 17).

Xu teaches that the temperature is 200°C.

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the temperature from 220 to 300°C in the invention of Xu, since temperature is a process variable and identifying the optimum or workable ranges require only routine experimentation by one of ordinary skill in the art. Note that the specification contains no disclosure of either the critical nature of the claimed temperature range or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen temperature range or upon another variable recited in a claim, the Applicant must show that the chosen temperature range is critical. *In re Woodruf*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

In re claim 2, Xu discloses wherein the substrate further comprises a hole (figure 8).

In re claim 3, Xu discloses before step i) forming a barrier/liner layer in the via channel (column 12, figure 8).

In re claim 4, Xu discloses wherein step ii) is conducted at a substrate temperature and a power sufficient to inhibit formation of filamentous metal phases (i.e. $TiAl_3$) with the barrier/liner layer, having resistivity greater than that of the metal (column 23).

In re claim 5, Xu discloses wherein the second amount of metal is deposited at a rate of about 5 to 30 Å/sec. (figure 15).

In re claim 6, Xu teaches that the second amount of metal is deposited at a pressure of 0.5 to 2 mTorr (column 24). Xu does not teach wherein the pressure is 4 to 6 mTorr.

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to deposit the second amount of metal at 4 to 6 mTorr, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller,* 105 USPQ 233. Note that the specification contains no disclosure of either the critical nature of the claimed pressure or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen pressure or upon another variable recited in a claim, the Applicant must show that the chosen pressure are critical. *In re Woodruf*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

In re claim 7, Xu discloses wherein the second amount of metal is deposited at a substrate temperature of 300 to 420°C (column 24).

In re claim 8, Xu discloses wherein the second amount of metal is deposited to form a layer of 400 to 3,000 Å thick (figure 15).

In re claim 9, Xu discloses wherein the metal is aluminum (column 24).

In re claim 10, Xu discloses depositing the seed layer at a power of 9,000W (i.e. 9kW) (column 15).

In re claim 11, Xu discloses wherein the seed layer is deposited at a pressure of 1 to 3 mTorr (column 15).

In re claim 12, Xu discloses wherein the seed layer is deposited at a rate of 100 to 200 Å/sec (column 20).

In re claim 13, Xu discloses wherein the seed layer is deposited to form a layer of 500 to 4,000 Å (column 20).

In re claim 14, Xu discloses wherein heating of the substrate in the second step is by backside gas flow (column11).

In re claim 15, Xu discloses wherein the gas is argon (column 11).

In re claim 16, Xu discloses wherein the opening has an aspect ratio of at least 3:1 (column 2).

In re claim 17, Xu discloses wherein the second amount of metal deposited is sufficient to fill the opening (figure 8).

In re claim 18, Xu discloses further including forming a liner/wetting layer is deposited in the opening before step i) (column 12).

In re claim 19, Xu discloses wherein the second amount of metal is deposited at a power of 100 to 800 W (column 20).

In re claim 20, Xu discloses wherein the opening has an aspect ratio of 2.5 (column 2).

Response to Arguments

8. Applicant's arguments filed 8/14/02 have been fully considered but they are not persuasive for the foregoing reasons.

Applicant contests that the double patenting is not proper because the '228 patent does not claim a liner which is Ti nor a seed layer.

Examiner respectfully submits that the '228 patent does claim both limitations. Claim 3, which is dependent of claim 1, of patent '228 discloses "further comprising before step i) forming a barrier/liner layer in said opening." Claim 21, which is dependent of claim 3, discloses "wherein said barrier/liner layer comprises a material selected from the group consisting of titanium, a titanium-tungsten alloy or titanium nitride."

Therefore, the double patenting rejection is valid and proper.

9. Examiner respectfully submits that Applicant did not address the art rejection of independent claim 21 and therefore, Examiner assumes that Applicant agrees with the rejection.

10. Applicant's arguments with respect to claims 1 – 20 and 22 – 24 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fernando Toledo whose telephone number is 703-305-0567. The examiner can normally be reached on Mon-Fri 8am to 4pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703-306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7382 for regular communications and 703-308-7382 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Fernando Toledo
Examiner
Art Unit 2823

ft
October 21, 2002

Olik Chaudhuri
Supervisory Patent Examiner
Technology Sector 2800